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## Field of the Invention

5           The present invention relates to a battery powered table saw that has a table and a  
saw unit vertically movably supported on the table.

### Description of the Related Art

Known motor driven saws, excluding permanently installed floor models, are generally classified as either portable saws or table saws. Portable saws are generally adapted to rest on and move along a workpiece so as to cut the workpiece. Table saws have a table for placing a workpiece thereon and have a saw unit vertically movably supported on the table, which saw unit can be moved downward toward the workpiece on the table so as to cut the workpiece.

15           Some known portable saws have a battery powered motor. For example, U.S. Design Patent No. 363,656 teaches such a portable saw. However, known table saws are driven by an AC power source and the applicant is not aware of any attempts to produce a battery-driven table saw. For example, U. S. Patent No. 5,782,153 teaches such a table saw that is driven by an AC power source. Thus, known table saws all require that an electric cord

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It is, accordingly, one object of the present invention to teach battery powered table saws.

Preferably, a table saw is taught which can increase the number and type of locations in which table saws can be used. In one representative aspect, a battery driven motor is provided on a saw unit, and a battery mounting device is provided on the table saw at an appropriate position. Therefore, the table saw can be used in places that do not have a commercial power source. In addition, the operator is not required to utilize a cumbersome generator. As a result, highly useful and versatile table saws are taught.

Preferably, a battery mounting device is utilized to mount the battery on the table saw and the position of the battery mounting device may be advantageously chosen to provide additional useful features. For example, the battery mounting device may be positioned adjacent to a switch for starting the motor, so that wiring between the battery and the switch can be shortened and simplified. Alternatively, the battery mounting device may be positioned such that the battery serves as a counterweight against the weight of the motor or



FIG. 8 is a side view of a fifth representative embodiment of a table saw wherein the saw unit in the uppermost position;

FIG. 9 is a plan view of the fifth representative embodiment;

FIG. 10 is a side view of a sixth representative embodiment of a table saw wherein  
5 the saw unit in the uppermost position; and

FIG. 11 is a plan view of a saw unit of the sixth representative embodiment.

#### DETAILED DESCRIPTION OF THE INVENTION

Preferably, a table saw includes a table for placing a workpiece thereon. A saw unit  
10 may be vertically and movably supported on the table and may have a saw blade mounted thereon. A battery-driven motor may be mounted on the saw unit for rotatably driving the saw blade and a battery mounting device may be provided to mount a battery on the table saw. Using this design, the battery powered table saw can be used in places that are far away from commercial power source outlets and the need for generators is eliminated.

15 In a first representative embodiment, the battery powered table saw has a handle and the battery mounting device is disposed on the handle. Preferably, the battery powered table saw includes a battery case for accommodating the battery, which battery case has an opening formed therein to permit foreign particles that may enter the battery case to be exhausted. The handle may have a switch mounted thereon and may be operable by the operator to start the

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In a third representative embodiment, the table saw may further include a base for supporting the table, and the battery mounting device may be disposed in the base. The table also may be rotatably supported on the base and may have a pair of auxiliary tables that are positioned on both sides of the table in opposed relationship with each other substantially in the diametrical direction of the table. The battery mounting device is preferably disposed in one of the auxiliary tables.

15           The saw unit may be mounted on a peripheral part of the table, so that the saw unit is positioned on one side in forward and rearward directions that is substantially perpendicular to the diameter of the table across the auxiliary tables when the table is in the reference position. In such a case, the battery mounting device on the other of the auxiliary tables is preferably positioned on the other side of the forward and rearward directions, so that the

battery mounted on the battery mounting device can serve as a counterweight to the saw unit moment.

In a fourth representative embodiment, the saw unit also may be vertically pivotable relative to the table around a pivotal axis, and the battery mounting device may be disposed on the saw unit in a position adjacent to the pivotal axis. The saw unit may have an upper stroke end and a lower stroke end. The position of the battery mounting device may be preferably chosen such that when the saw unit is at the upper stroke end, the battery center of gravity is positioned on one side of a vertical plane extending through the pivotal axis while the saw unit center of gravity is positioned on the other side of the vertical plane. Further, when the saw unit is at the lower stroke end, the battery center of gravity center is preferably positioned substantially within the vertical plane.

In a fifth representative embodiment, the saw unit also may include a blade case to partly cover the saw blade. In such design, the battery mounting device may be disposed on the blade case and, preferably, on one lateral side of the blade case opposite to the motor.

In a sixth representative embodiment, the handle and the battery mounting device and the motor may be positioned substantially within the same plane as the saw blade.

Preferably, the motor has a motor shaft that extends in parallel with a rotational axis of the saw blade and is spaced therefrom. The rotation of the motor shaft may be transmitted to the saw blade by means of a belt.



**Figure 1**

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be a rechargeable battery that is normally used in power tools. In particular, the battery 20 may be a Ni-Cd rechargeable battery having an output power rating of about 18V. Suitable batteries are manufactured and distributed by the assignee company of this application, Makita Corporation of Aichi-ken, Anjo-shi, Japan, under the product name "BATTERY 1822".

5 A lid 22 may be connected to the battery case 21 by means of a hinge 22a so as to open and close an open end of the battery case 21. The lid 22 may serve to prevent foreign particles from entering the battery case 21.

The battery 20 may have a pair of spring-biased push buttons 20a (one shown in FIG. 1) disposed on both lateral sides thereof. Each of the push buttons 20a may have an  
10 engaging claw 20b formed on its outer end. The battery case 21 may have engaging portions formed at the open end for engagement with the corresponding engaging claws 20b. In order to mount the battery 20 within the battery case 21, the operator may hold the battery 20 with the push buttons 20a while manually depressing the push buttons 20a, insert the battery 20 into the battery case 21, and then release the push buttons 20a. As a result, the engaging claws  
15 20b automatically engage their corresponding engaging portions of the battery case 21, so that the battery 20 can be fixed in position within the battery case 21. In order to remove the battery 20 from the battery case 21, the operator may depress the push button 20a so as to disengage the engaging claws 20b from the engaging portions of the battery case 21.

The battery case 21 may have positive and negative power source terminals 21b

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(one shown in FIG. 1) that are mounted on the bottom of the battery case 21 and extend into the interior of the battery case 21 for connection to the battery 20. The terminals 21b are connected to a motor drive circuit including the motor 20 and the switch 17, so that the motor 12 can start to rotate the saw blade 13 when the operator turns on the switch 17. A discharge opening 21a may be formed in the battery case 21 adjacent to the bottom of the battery case 21, so that any foreign particles that have entered the battery case 21 can be exhausted to the outside. Of course, the foreign particles also may be exhausted through the open end of the battery case 21 when the lid 22 is opened.

According to the representative embodiment shown in FIG. 1, the motor 12 can be driven by the power supplied from the battery 20. Therefore, the table saw 1 can be used even in places in which AC power source outlets are not conveniently located. Thus, the operator is not restricted in his or her use of the battery powered table saw.

In addition, because the battery casing 21 is formed on the handle 16, the battery 20 may be positioned adjacent to the motor 12 and the switch 17. Therefore, the wiring length between the terminals 21b and the motor 12 can be shortened, and the wiring operation can be simplified.

Further, by closing the battery casing 21 with the lid 22, foreign particles, such as cutting chips, may be prevented from entering the battery casing 21. Therefore, problems, such as improper mounting of the battery 20 and improper conductive condition of the motor

drive circuit, can be reliably prevented. Moreover, because foreign particles entering the battery casing 21 may be discharged to the outside from the discharge opening 21a, the interior of the battery casing 21 can be kept free from foreign particles. Naturally, the lid 22 may be opened to discharge the foreign particles through the open end of the battery casing 21.

5           Second to sixth representative embodiments of table saws will now be explained with reference to FIGS. 2 to 10. In these drawings, like members are given the same reference numerals as in FIG. 1. In each of these representative embodiments, the table saw can be used in places, in which outlets are not provided. Thus, highly versatile and useful table saws are taught.

10           A second representative embodiment of a table saw is shown in FIG. 2, in which the DC motor 32 of the table saw 30 is driven by a battery 31 as the power source. In this design, a battery case 34 may be integrally formed with a front portion (left portion as viewed in FIG. 2) of a handle 33 that is operable by an operator for vertical pivotal movement of a saw unit 35. The battery 31 may have a pair of spring-biased push buttons 31a (one shown in FIG. 2) 15 disposed on both lateral sides thereof. Each of the push buttons 31a may have an engaging claw 31b formed on its outer end. Therefore, the battery 31 may be mounted within and removed from the battery case 34 in the same manner as the first representative embodiment. Also, positive and negative power source terminals 34a are mounted on the bottom of the battery case 34 in the same manner as the first representative embodiment.

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Thus, a battery case 41b is mounted within the front portion of the auxiliary table 41a disposed on the lower side as viewed in FIG. 4. A battery 40 may be inserted into and removed from the battery case 41b for charging. As in the first and second representative embodiments, the battery 40 may have a pair of spring-biased push buttons 40a on opposite sides thereof, so that the battery 40 can be removably held in position relative to the battery case 41b.

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The construction of the saw unit 46 may be the same as the first and the second embodiments with the exception of the handle 47, which does not have a battery case mounted on the handle 47. However, the handle 47 may have a lock button 47b similar to the lock button 17 of the first and second representative embodiments, as well as the switch 47a.

5           In addition, by virtue of the arrangement of the battery casing 41b on one of the auxiliary tables 41a, which is positioned on one lateral side opposite to the motor 12, the battery 40 may serve as a counterweight to the moment of the motor 12, which moment exerts a force on the saw unit 46 in the lateral direction.

Further, by virtue of arrangement of the battery casing 41b on the front side of the auxiliary table 41a, the battery 40 may also serve as a counterweight to the moment of the entire saw unit 46 that is positioned on the rear side of the table 3. Consequently, the battery 40 may serve as a balance weight to enable the table saw 45 to be stably placed on the floor.

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41a



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uppermost position. Thus, the spring may have a smaller spring constant, which will enable



the operator to pivot the saw unit 55 for the cutting operation more easily. Therefore, the cutting operation can be easily and smoothly performed with less strain on the operator.

The fifth representative embodiment of a table saw will now be described with reference to FIGS. 8 and 9, in which a battery case 64 is formed on a blade case 63 of a saw unit 62 on the opposite side to the motor 12. More specifically, the battery case 64 for mounting a battery 61 is disposed on one of the side surfaces of the blade case 63 on the opposite side to the motor 12 and is adjacent the pivotal axis 7. Also, positive and negative power source terminals 64a may be mounted on the bottom of the battery case 64 for connection to the motor drive circuit. In other respects, the construction of the saw unit 62 (in particular, the handle 47) may be the same as the saw unit 46 of the third representative embodiment.

With this arrangement, the battery 61 may be positioned on the side opposite to the motor 12 with respect to the blade case 63. Therefore, the battery 61 may serve as a counterweight against the weight of the motor 12 so as to provide a weight balance to the saw unit 62.

The sixth representative embodiment of a table saw will now be described with reference to FIGS. 10 and 11, in which a belt 72 connects the output shaft of a DC motor 73 to a saw blade 72. This is a principal difference between the table saw 70 and the table saws 1, 30, 45, 50 and 60 of the first to fifth representative embodiments, in which the saw blade 13

is directly connected to the output shaft of the motor 12.

The table saw 70 may include a slide support mechanism 75 that permits a saw unit 80 to move in the horizontal direction or the direction parallel to an upper surface of a table 74, as well as the pivotal movement in the vertical direction. Thus, the support mechanism 75 includes a vertical support 83 and a sleeve 84. The vertical support 83 is laterally pivotally mounted on the rear end of the table 74 and has a slide shaft 85 secured to its upper end. The sleeve 84 is slidably movable relative to the slide shaft 85 and has a front end, on which the saw unit 80 is vertically pivotally mounted. The table 74 is horizontally rotatably mounted on a base 76 in the same manner as the previous representative embodiments. Preferably, a battery 82 may be mounted on a handle of the saw unit 80 and may be electrically connected to the motor 73.

By virtue of the incorporation of the belt 71 that transmits the rotation of the motor 73 to the saw blade 72, the motor 73, the battery 82 and the handle 81 may be arranged substantially in alignment with each other on the plane of the saw blade 72 as shown in FIG. 11. With this arrangement, a weight balance may be achieved between the right and left directions of the saw unit 80. In particular, because the motor 73 may be disposed equally on the right and left sides about the plane of the saw blade 72, the saw unit 80 may be permitted to pivot by substantially the same angle on both the right and left side directions when a cutting operation is performed with the saw blade 72 inclined in the lateral direction relative

74. Therefore, the table saw 70 may be improved in operability also in this respect.

Further, with the arrangement of the battery 82 between the motor 73 and the handle 81, the wiring operation of the motor drive circuit can be easily performed.

5           As a person of skill in the art will readily understand, the second to sixth  
representative embodiments may be modified in various way without departing from the  
invention.

For example, the battery cases 34, 41b, 53 and 64 of the second, third, fourth and fifth embodiments, respectively, may have discharge openings for discharging foreign particles or may have lids for preventing foreign particles from entering the battery cases.

In addition, although the present invention has been described in connection with two different types of table saws, one type of the first to fifth representative embodiments, and the other type of the sixth representative embodiment, the present invention may be applied to any kinds of table saws.

15 Further, the battery case or battery may be disposed at any position and is not limited to the locations disclosed in the representative embodiments. For example, the battery case may be disposed below the base of the table.

Furthermore, although the batteries in the above representative embodiments may be removed from the battery cases for the purpose of the charging operation or may be

discarded for replacement with a new charged battery, the batteries may be fixedly mounted to the battery cases. However, in such a case, the operator may be require to move the table to a position where an electrical outlet is available in order to perform the recharging operation.